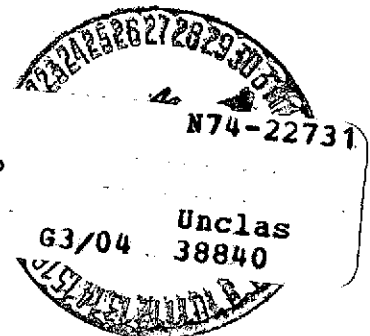


ESSENTIAL OBESITY

F. Matzkies

Translation of "Essentielle Fettsucht",
Fortschritte der Medizin, Vol. 90,
1972, pp. 765 - 768.

(NASA-TT-F-15589) ESSENTIAL OBESITY
(Scientific Translation Service) 15 P HC
\$4.00 14 CSCL 06P



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Definition

The expressions obesity, corpulence and adiposity are used synonymously to designate overweight of more than 10 kg. The calculation is done by the Broca formula, considering age and sex as well as the normal weight of the population (Ries).

The designation is symptomatic obesity if the etiology is known, while the expression essential obesity is used with unknown etiology.

Pathogenesis

Independent of the particular cause, overweight can only develop if sufficient highly caloric food is taken in over a long period of time. A reduced energy expenditure can only be considered a second factor. As appears from the eating histories of patients with obesity, both polyphagia and hypomotility are of such minor extent that they are usually not noted by the patient himself. With appropriate disposition, incorrect nutrition of 5% above the daily caloric consumption is enough to produce a weight increase of 1 kg within 2 months.

* Numbers in the margin indicate pagination in the original foreign text.

Classification

As central nervous or endocrine disorders can hide behind the symptom of adiposity, a differential diagnosis becomes necessary. Classification is a first step in differential diagnosis measures. It can be done from different viewpoints. Statements on the time of manifestation, the type of fat distribution and the stage of the disease are common.

The attempt at classification according to the etiology requires a special course of investigation, in which an eating history should be collected along with family and individual histories.

In the physical examination, special note should be taken for signs of feminization or virilization. Special investigations will then determine disturbances of the central nervous system, of metabolism, or of the hormone and water balance. If the symptoms of gynecomasty, hirsutism and Striae distensae appear, it is particularly easy to accept hormonally caused obesity. But this conjecture applies only if these signs are especially strongly expressed even at the beginning of obesity.

It must be expected that, as for essential hypertonia, more and more secondary forms of obesity will be differentiable from the essential form. The number of diseases recognized which lead to obesity is still small. So far it has been possible to demonstrate cerebral forms after damage to the hypothalamus through trauma, poisoning or infection. Development of tumors in the hypophysis, the adrenal glands, and the islet organs of the pancreas lead obligately to obesity, while disturbances of the thyroid function or loss of the gonads cause only a moderate overweight.

Because of its frequency, obesity has always demanded medical interest. Monographs and handbook articles on corpulence and obesity have appeared at regular intervals since as early as 1888. But exact clinical research into obesity has begun only in the last decade. At the center of this research are studies of the hunger and eating center in the hypothalamus, the hormonal secretion and the characteristics of obesity itself.

Obesity has been produced in animal experiments through mechanical, chemical or infectious damage to the eating centers in the hypothalamus (Figure 1, Anand and Brobeck). Changes can

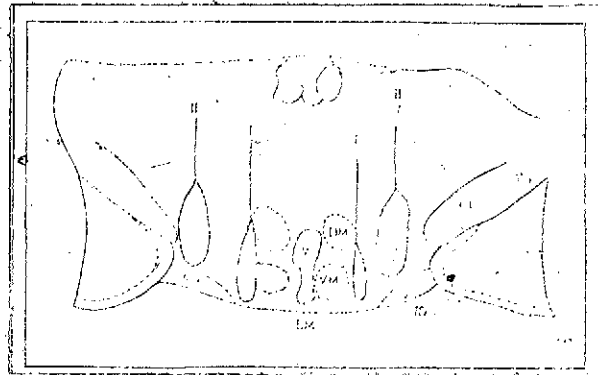


Figure 1. Eating centers in the hypothalamus (according to Anand and Brobeck, 1951).

- I = medial satiation center
- II = lateral hunger center

also be found in the fat tissue itself, which favor the initiation of adiposity. If mice with hereditary obesity are injected with glucose, there is accelerated incorporation of glucose into the

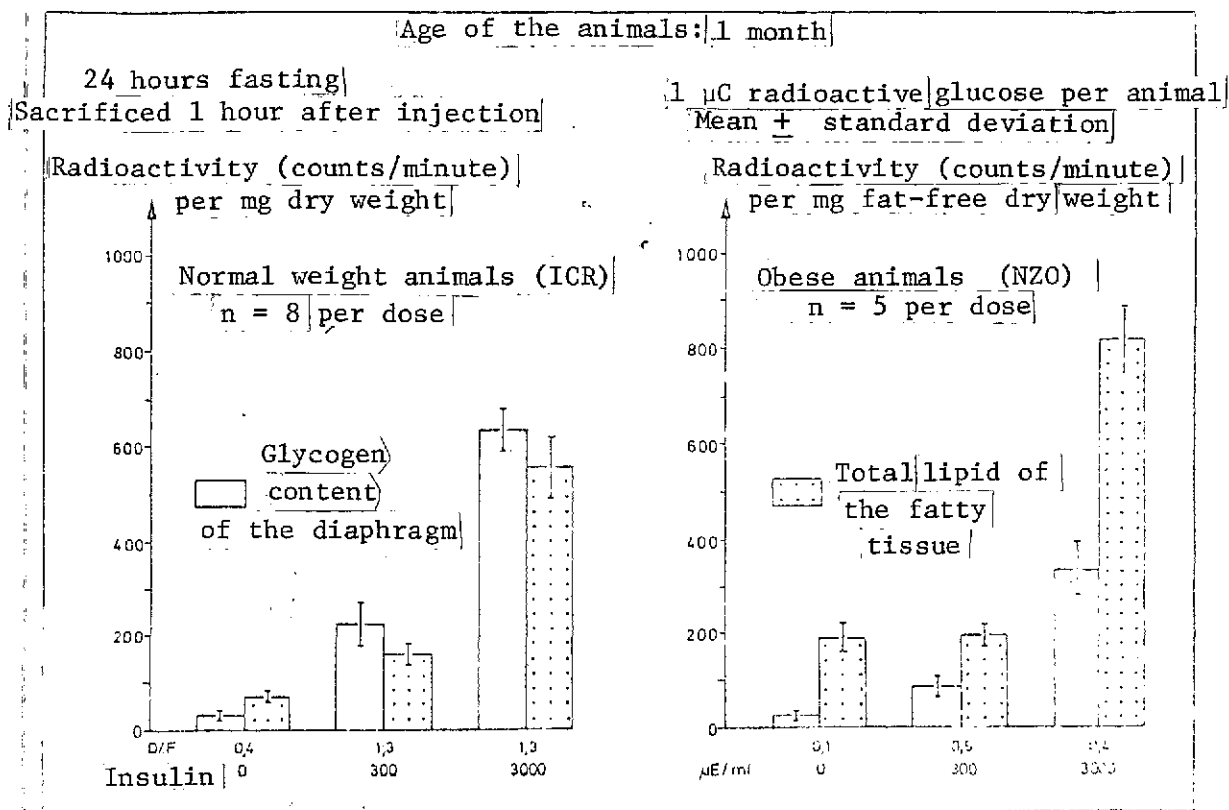


Figure 2. Intraperitoneal injection of radio-labeled glucose and low doses of insulin in an obese (NZO) and a control strain of mice (according to Renold and Cahill, 1965).

fatty tissue, in contrast to mice without the hereditary stress (Figure 2, Renold and Cahill). These findings can only in part be transferred to humans.

Clinic

Obesity leads to a considerable shortening of life expectancy. In the following, therefore, we shall investigate the individual organs through which changes due to obesity produce the increased mortality and morbidity.

Blood

The blood volume is reduced in relation to the body weight. The hemoglobin concentration and the erythrocyte number remain normal, while the neutrophilic leukocytes are increased even without signs of infection.

The blood proteins also show specific changes in essential obesity. The albumin-globulin ratio is shifted toward the globulins, with the α_1 and β globulins in particular being increased.

The sedimentation rate of the blood cells is also distinctly increased without signs of inflammatory reaction. Obese persons are particularly endangered due to the reduced fibrinolytic activity with increased thrombocyte agglutination. There is increased danger of thrombus formation because of this hypercoagulability.

Heart and circulation

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In obese persons the heart is heavier and changes its position either through a transverse shift or, if this is no longer possible because sclerosing of the vessels has already occurred, through shortening.

The heart volume is increased by $10.5 \text{ cm}^3/\text{kg}$ overweight in men and by $4.3 \text{ cm}^3/\text{kg}$ overweight in women. As the heart rate is also accelerated at rest and in stress, the result of this behavior is a considerably increased heart minute volume. The blood pressure rises in proportion to the overweight. This favors development of arteriosclerosis and of coronary heart disease in particular.

Accumulated varices are found in obesity as a result of the increased venous pressure. The reduced circulatory rate and the increased occurrence of hypotonic or hypodynamic circulatory regulatory disturbances favors tissue hypoxia under stress. The increased development of hematomas is due to a reduced capillary resistance.

Lungs

Lung function in adiposity has been particularly well investigated. The fat person has lungs which are too small in proportion to his weight. The required respiratory capacity can, therefore, be produced only by increased respiratory action (hyperpnea). The extent of rest and stress dyspnea is linearly dependent on the degree of overweight.

Digestive Organs

The digestive organs also show some typical changes. In comparison to normal persons, obese persons frequently suffer spastic obstipation. Fatty degeneration of the liver epithelium to varying extent, with functional limitation, is regularly demonstrated. Although there is a distinct fatty permeation of the pancreas, its endocrine and exocrine function is not limited.

Skeleton

Osteoporosis and arthrosis occur frequently in the skeleton and at the joints as a result of overweight.

Endocrine System

Through the study of the activity of the endocrine glands in obesity, findings were collected which have been particularly vigorously discussed in relation to the etiology of the affliction. It appears, however, that the activity changes of the endocrine organs are reversible after weight loss, so that they must be considered not as a cause of the gain in weight, but as a result of it. Of course, many hormones have not yet been investigated sufficiently. In isolated cases an increase of the growth hormone has been described (Kleine). Hyperhormonal syndrome with adiposity as a result of increase in gonadotropin has been found in young girls (Beclere and Geugan). In adiposity which develops after delivery, the luteotropic hormone is said to be reduced (Reiss). The importance of the vasopressin increase is disputed, as water retention in obesity is found only in isolated cases (Zondek). Of the peripheral hormones, insulin, aldosterone and hydrocortisone are distinctly increased (Karam et al., Vague et al.).

Hypoglycemic reactions, hypokaliemia and signs of Cushing's disease are often found as expressions of the hormonal disturbances. This also appears to explain many changes in intermediary metabolism, which we cannot go into here.

One significant finding is the demonstration of reduction of dehydroepiandrosterone (Sonka et al.). Dehydroepiandrosterone is a decisive inhibitor of glucose-6-phosphate dehydrogenase, which is the first enzyme of the pentose phosphate cycle.

Increased lipogenesis is favored by loss of the pentose cycle limitation. This finding has not yet been confirmed.

Therapy of Obesity

There is an indication for treatment of obesity in all cases in which serious complications have appeared.

First, a positive motivation must be generated in the patient in a medical conference. In counseling on diet, an attempt is made to encourage the patient to change his eating habits. Explanation of the caloric content of the individual foods is of particular importance to produce an appropriate change in the food composition. Several methods are available to carry out the dietetic therapy.

Choice of the form of treatment must depend on the individual possibilities.

Reducing Diet

Prescription of a reducing diet is practiced most frequently, with the carbohydrate, fat and protein content of the food being reduced evenly. By using foods extremely low in calories there is a possibility of producing an adequate feeling of satisfaction in the patients in spite of the reducing diet. But such a diet presents the highest requirements both financially and in cooking technique.

Selection Diet

The advantages of forms of selection diet were noted even very early. The basic principle of this form of diet consists in unilateral elimination of carbohydrate, fat or protein from the

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food. The caloric intake can remain normal, or can even be raised. Particularly good and encouraging results were obtained with an isocaloric diet extremely low in carbohydrates.

With the reducing and selection diets the weight losses are 100 - 200 g/day. This means that reducing cures must extend over a period of 150 - 300 days.

Formula Diet

As deficiency symptoms can occur due to an unbalanced diet, food concentrates adapted for their prevention were developed. Such formula diets have decisive advantages in comparison to other measures. They ensure optimum supply of essential food components and lead to equalized nitrogen balance. They do not require any cost for cooking technique.

Long-term Fasts

Since the discovery that the brain can use not only glucose but also metabolites of fat metabolism as nutrient substrates, long-term fasting has been introduced as a new internistic method for treating decompensated obesity. A rapid weight loss can be accomplished by a fasting cure under clinical attention without a feeling of hunger.

Drug therapy with hormones, metabolically active substances, and appetite controllers must be limited to individual cases, as all the preparations have significant side effects.

Summary

Any person overweight by more than 10 kg, as calculated according to Broca and Ries, is considered to be obese. The concepts of adiposity, obesity and corpulence are used synonymously. In cases where the cause of the affliction is known, there is symptomatic obesity, while the expression 'essential obesity' is used with unknown etiology.

In each case, the disease arises from long-term overeating, while hypomotility contributes to development of obesity to a smaller extent.

The increased morbidity and mortality in obesity are caused by changes in the cardiovascular system, the lungs, the digestive organs and in the skeleton, and by the altered hormone secretions.

Therapeutic measures are introduced by a medical discussion intended to generate positive motivation for weight reduction. Various dietetic measures can be used to carry out weight-reduction cures.

A reducing diet is most often prescribed. We recommend limitation of carbohydrates for treatment of minor overweight. Hospital observation is necessary for fasting cures. Drug therapy is considered to be contraindicated at present because of the side effects.

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Translated for National Aeronautics and Space Administration under contract No. NASw 2483, by SCITRAN, P. O. Box 5456, Santa Barbara, California, 93108.

1. Report No. NASA TT F-15,589	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Essential obesity		5. Report Date May, 1974	6. Performing Organization Code
		8. Performing Organization Report No.	10. Work Unit No.
7. Author(s) F. Matzkies		11. Contract or Grant No. NASw-2483	
		13. Type of Report and Period Covered Translation	
9. Performing Organization Name and Address SCITRAN Box 5456 Santa Barbara, CA 93108		14. Sponsoring Agency Code	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, D.C. 20546			
15. Supplementary Notes Translation of "Essentielle Fettsucht", Fortschritte der Medizin, Vol. 90, 1972, pp. 765 - 768.			
16. Abstract Obesity is overweight by more than 10 kg. Essential obesity indicates unknown etiology. All cases derive from overeating for long periods, with lesser contribution from reduced exercise. Obesity reduces life expectancy through changes in the cardiovascular system, lungs, digestive organs, skeleton, and endocrine glands. The first step in therapy is motivating the patient to reduce weight. The usual measure is a reducing diet, especially with carbohydrate limitation. Formula diets are useful, and extensive weight loss can be attained by fasting under medical observation. Drugs are usually undesirable because of their side effects.			
17. Key Words (Selected by Author(s))		18. Distribution Statement Unclassified - Unlimited	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 14	22. Price 4.00